



Discovering, Applying and Sharing New Knowledge

Kentucky Transportation Center
Annual Report
2004

Kentucky Transportation Center

Our Mission

We provide services to the transportation community through research, technology transfer and education.

We create and participate in partnerships to promote safe and effective transportation systems.

We Value...

Teamwork

Listening and communicating along with courtesy and respect for others.

Honesty and ethical behavior

Delivering the highest quality products and services.

Continuous improvement

in all that we do.



Kentucky Transportation Center Annual Report 2004

Contents

Message from the Director	ii
<i>Research</i>	
Community Transportation Innovation Academy	1
Construction Engineering and Management	2
Geotechnology	3
Intelligent Transportation Systems	4
Pavements and Materials	5
Structures and Coatings	6
Traffic Safety	7
<i>Technology Transfer</i>	8
Financial Snapshot	9
FY 2004-2005 Kentucky Highway Research Projects	9
Research Reports Published During FY 2003-2004	10
Staff	12
Advisory Board	13
Locations	14



The Center's Technology Transfer unit presented 165 training events across the state attended by 4,315 individuals from county, city and state transportation agencies as well as industry and others involved in constructing and maintaining Kentucky's highway system.



*Paul Toussaint, Director
Kentucky Transportation Center*

Message From the Director

Discovering, applying and sharing new knowledge is our number one goal. It is fundamental to our existence—using research to improve transportation throughout Kentucky. However, any investment in research and its implementation is never undertaken without some element of risk. Normally we can evaluate the science and technology of our research results and reasonably predict what can be successfully implemented, or at the least minimize the risk associated with a change.

However, some people are skeptical about making changes, or taking risks, no matter how good the science and technology is that supports the recommendations. As the level of risk increases, it becomes more and more difficult to make changes, thus making it easier to accept the status quo.

Both nationally and locally, transportation is facing some serious challenges (risks), mainly

funding. The knowledge base identifying the funding crisis is clearly documented—funding has not kept up with inflation or the growing transportation needs. Continued under-investment in the transportation infrastructure will impact safety, capacity, congestion, maintenance and even the economy. In the short run, the transportation system is somewhat resilient to funding shortages; however, in the long run, the lack of funding will impact the system rapidly.

Risk is a small word that has permeated our everyday vocabulary since the events of September 11, 2001. In this case, the security needs have been recognized, the risk determined unacceptable and funds committed. On a less dramatic scale, we know the growing risk of a poorly funded transportation system. We must acknowledge this risk and invest accordingly. Under-investing in transportation is a great risk for both our nation and the state.

Community Transportation Innovation Academy



Ted Grossardt
Program Manager



RESEARCH

Highlighted Project: **The Use of Visualization and Preference Modeling in the Design of Sound Walls**

This innovative project is a collaboration between the Transportation Center, the UK Department of Landscape Architecture, and the Speed Scientific School at the University of Louisville. Together, they are developing a method to allow the public to express their preferences for various design combinations of sound walls that deliver different visual impressions and sound attenuation. Because the appearance of a barrier can affect one's perception of the amount of sound it transmits, citizens will be allowed to assess the appearance and effectiveness of various sound wall designs simultaneously, thus allowing designers to create the optimal sound wall for the local neighborhood and the budget.



EDUCATION

Highlighted Project: **Pre-Construction Project Managers Academy**

This eight-day training course is designed to help District-level Project Managers understand and accommodate the wide range of demands placed on a Pre-Construction Project Manager. Participants are trained to be able to create detailed project management time lines and schedules, on the one hand, while learning how to deal with the public and to give a good TV or radio interview, on the other. Instructors range from former Transportation Cabinet employees to UK researchers to citizens who have worked with the Cabinet on specific projects. The Center partnered with the Cabinet to develop and pilot this course.



Construction Engineering & Management Research



Donn Hancher
Program Manager

Highlighted Project: **Innovative Rapid Construction/Reconstruction Methods**

A vast majority of the Kentucky Transportation Cabinet's (KyTC) construction projects are now reconstruction and rehabilitation projects. Meanwhile, the volume of traffic on KyTC roads is increasing, environmental regulations are becoming stricter, and the cost of conventional road and bridge construction is on the rise. Conventional construction and reconstruction methods will be seriously strained to meet the demands of future KyTC needs, especially the current philosophy of "Get In, Get Out, and Stay Out." In order to sup-

Major 2004 Projects

- Impact of Outsourcing KyTC Project Services
- Innovative Rapid Construction/Reconstruction Methods
- Lessons Learned – Proof of Concept and Implementation Support

port this initiative, researchers have assembled a database of rapid methods of construction that are being used successfully by other state transportation agencies. Currently, a series of case studies of current and past roadway projects in Kentucky is being developed to identify additional rapid methods of construction as well as lessons learned in their use. The research is also developing cost models to be used at the conceptual stage of a project to assist in identifying possible rapid methods of construction.





Tommy Hopkins
Program Manager

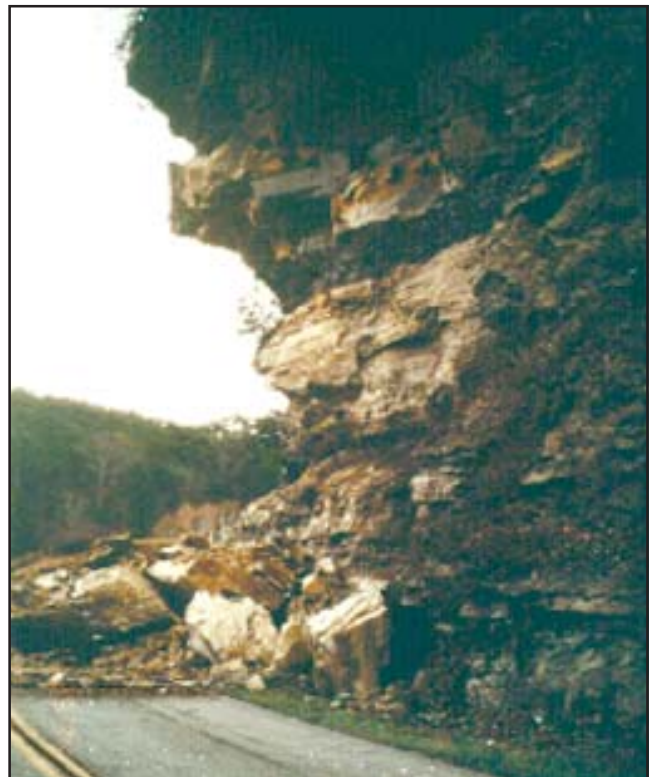
Highlighted Project: **Kentucky Geotechnical Database**

Geotechnical data are extremely valuable in the planning of new highways, providing landslide and rock slope management systems and providing the means for comparing the merits of different highway corridors. Historical soil and rock engineering data, obtained from borings, can be analyzed for local, regional, or statewide conditions.

The major aim of the Kentucky Geotechnical Database is to provide an effective tool to examine and analyze regional geotechnical data, and thereby enhance the state's management of their Transportation System. The database provides permanent electronic storage of geotechnical data and is accessible by all highway districts via a server in Frankfort, Kentucky. The rock slope and landslide modules are very useful in generating and prioritizing sites for the KyTC Six-Year Plan. Cabinet personnel in the 12 highway districts have been trained to enter landslide and rock slope information and use the management systems. An interactive web browser is being built to facilitate access to and use of the Kentucky Geotechnical Database.

Major 2004 Projects

- Reduction of Stresses on Buried Rigid Highway Structures using the Imperfect Ditch Method and Expanded Polystyrene (Geofoam)
- Resilient Modulus of Aggregate Bases
- Investigation of the Soft Zone in Highway Subgrades
- By-products Resource Manual
- Use of Ultra-Light-Weight Materials to Reduce Stresses in Highway Culvert Extensions
- Bearing Capacity Analysis and Design of Highway Base Materials Reinforced with Geofabrics



Intelligent Transportation Systems (ITS) Research



Joe Crabtree
Program Manager

Highlighted Project: **Development, Integration and Testing of an Onboard Commercial Vehicle Safety System**

KTC has partnered with the Calspan/University of Buffalo Research Center (CUBRC) to design, develop, and test an integrated on-vehicle safety system for trucks, to provide Automatic Collision Notification (ACN), Automatic Vehicle Location (AVL), and Automated Brake Monitoring (ABM). The system uses individual technologies developed by Veridian Engineering (now part of General Dynamics).

Accomplishments include developing the ABM technology (including an in-cab display), integrating the individual technologies into a single system, and performing extensive testing of the system in laboratory and real-world environments. The next step in the process is a more extensive fleet deployment and evaluation.

This project also has funded an expansion of Kentucky's commercial vehicle electronic screening program, as well as the ongoing evaluation of Kentucky's first Virtual Weigh Station.

Major 2004 Projects

- Development, Integration, and Testing of an Onboard Commercial Vehicle Safety System (with the Calspan/University of Buffalo Research Center).
- Development of an Archived Data Management System (ADMS) Prototype.
- Evaluation of Methods to Reduce the Time Taken to Investigate Crash Sites.
- Development of an ITS Maintenance and Operations Plan for Kentucky.
- Analysis of ITS Procurement Practices in Kentucky (with UK College of Law).
- Assessment of Data Collection for Equivalent Single-Axle Load (ESAL) Determinations (with Pavements & Materials Section and Traffic & Safety Section).



Pavements & Materials Research



David Allen
Program Manager

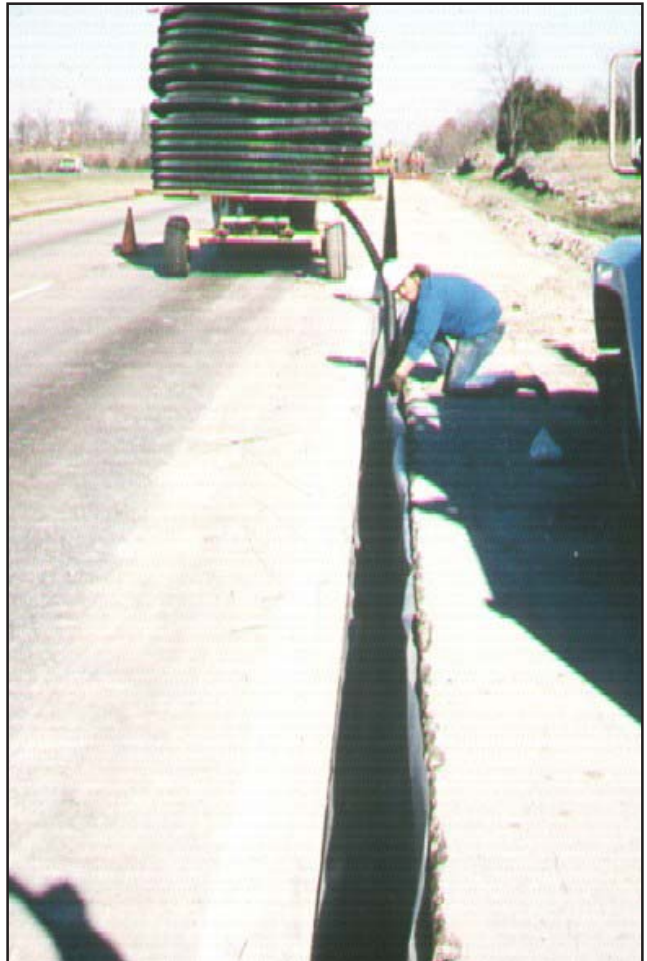
Highlighted Project: **Pavement Drainage**

Pavement drainage plays a critical role in the performance of the pavement structure. Numerous factors affect the ability of a pavement structure to remove moisture which may have infiltrated the pavement either through ground water or surface water infiltration. Infiltration from surface water may be controlled by varying the permeability of the pavement surface. Techniques have been developed to measure the permeability of hot-mix-asphalt (HMA) pavement surfaces. In addition, models have been developed to allow for the prediction of the permeability based on the gradation properties of the HMA mix. Kentucky is currently evaluating the use of the prediction model in conjunction with a permeability construction specification to control pavement permeability. By controlling the infiltration of moisture into the pavement structure, improved performance may be achieved. This will improve the life-cycle cost of the pavement structure by lengthening the time between required rehabilitations.



Major 2004 Projects

- Utilization of Pavement Profiling Equipment to Determine As-built Transverse and Longitudinal Profiles of Existing Highways
- Development of Pavement Distress Manual
- Development of an Integrated Materials, Design, Construction and Experimental Features Database
- Implementation Plan Development for NCHRP 1-37A Pavement Design Guide



Structures & Coatings Research



Issam Harik
Program Manager

Highlighted Project: Rapid Deployment Maintenance Painting: I-64 Overpass Bridges Over Story and Mellwood Avenues in Louisville

KyTC is seeking new approaches to bridge maintenance that limit inconvenience to the motoring public. "Rapid Deployment Painting" is a new method used to accelerate painting of overpass bridges. Access to those bridges is restricted to off-peak hours and closures of underlying lanes of traffic are limited to one traffic direction. The contractor is given minimum operating hours to establish containment over the areas to be painted, remove the existing paint by abrasive blasting, and apply subsequent multiple coats on new paint. A special two-coat, rapid-cure paint system was used on this project to reduce painting time. KyTC provided six inspectors to facilitate quality assurance for the paint work. This type of project requires significant planning by a contractor and good coordination between his workers and KyTC project managers. To ensure minimum inconvenience to motorists, the contract provides the contractor with financial incentives if the work is completed in less than the allotted access time, and significant disincentives if the work exceeds it.

Major 2004 Projects

- Testing/Calibration of Bridge Management System
- Multi-Barge Impact Forces on Bridges
- Seismic Evaluation of Parkways in Western Kentucky
- Remote Sensing Technology for Post Earthquake Evaluation of Highway Bridges
- Rapid Deployment Painting on Bridges in Louisville and Lexington
- Evaluation of Coatings to Address Concrete Deterioration
- Disposal of Bridge Paint Debris





Jerry Pigman
Program Manager

Highlighted Project: **Traffic Crashes at Intersections**

Trends indicate that more than one-third of all crashes, including injury and fatal crashes, occurred at intersections. Research was undertaken to assess the types, causes, frequency and location of crashes at intersections. Specific objectives of the overall research study were:

- ◆ Identify high-crash locations.
- ◆ Develop an interactive computer process to analyze intersection crashes.
- ◆ Investigate traffic control at stop sign approaches.
- ◆ Examine the safety consequences of U-turns at signalized intersections.

Results included an improved understanding of the characteristics of crashes at intersections and state-of-art tools for impacting locations where there is an unusually high frequency of crashes. Specific results and findings from the research include:

- ◆ Approximately 7,000 intersections and nearly 19,000 crashes were analyzed for the period 2000 through 2002 to identify locations in need of counter measures.
- ◆ An interactive computerized process was developed to equip highway safety personnel with tools for investigating high-crash locations and determining safety improvements.
- ◆ Stop-controlled intersections with a high number of crashes related to “disregarding the traffic control” were analyzed and recommendations made for improving the safety of these intersections.
- ◆ Sections of road with U-turns permitted at signalized intersections were analyzed and it was determined that the efficiency of roadway segments can be improved without negative safety impacts.

Major 2004 Projects

- Traffic Crashes at Intersections
- Usage of GPS Technology for Traffic Crash Location
- Effects of Pavement Resurfacing on Traffic Safety
- Access Management Guidelines Effect of Warning Signs on Operating Speeds
- Evaluation of Auto Incident Recording System
- Safety Consequences of Flexibility in Highway Design
- Evaluation of Traffic Information Prediction System



Technology Transfer



Patsy Anderson
Program Manager

The Technology Transfer (T²) Program serves as Kentucky's Local Technical Assistance Program (LTAP) providing workshops and training events, how-to manuals, expert advice, legislative and regulatory news, on-site technical assistance and access to the only transportation library in the state. T² receives funding from the Federal Highway Administration's LTAP program, the Kentucky Transportation Cabinet and the University of Kentucky.

This fiscal year, T² participated in two satellite downlinks, "Safety Conscious Transportation Planning" and "Environmental Information Management and Decision Support System for Transportation Agencies."

In cooperation with the Transportation Cabinet, T² assisted six Area Development Districts in presenting Highway Crash Site Management workshops.

The Preconstruction Project Manager Academy is a collaborative effort between the Cabinet and the Center to provide technical information to those employees managing projects. T² managed the academy presentation. T² also assisted the Cabinet with a one-day training session on Roundabouts.

T² staff assisted in the presentation of a one-day conference titled "Collision Data Analysis Workshop," and presented a two-day course on International Municipal Signal Association (IMSA) Level I certification program.

Once again T² worked with the KY Department of Agriculture on providing continuing education credits for pesticide certification holders in Category 3 and 6. The Center presented 23 workshops across the state. T² also held five initial certification sessions for Category 6.

To respond to the need for professional-level training focused on systematic reviews of Environmental Impact Assessment (EIA) the Center held a three-day course titled "Review of National Environmental Policy Act" (NEPA).

T² also worked with the Kentucky APWA Chapter to host a Leadership Workshop with attendees representing six states.

Major 2004 Projects

- Presented 165 training events attended by 4,315 transportation workers.
- Conducted the Asphalt Certification program leading to the certification of 54 new technologists and the recertification of 34 technologists.
- Presented the Asphalt Field Technician Certification resulting in 179 individuals earning their certification.
- Issued quarterly newsletter
- Added 673 items to the Library holdings and loaned 1,128 library materials, including 419 videos.
- At the request of the Kentucky Transportation Cabinet, the library staff updated the history and provided statistical analysis of the Cabinet's Transportation Scholarship Program.



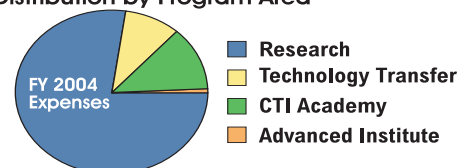
The Technology Transfer unit at the Center encourages hands-on learning at many of its workshops including this one on Drainage: the Key to Roads That Last.

Financial Snapshot

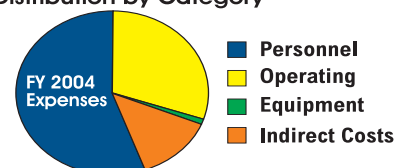
FY 2004 Expenditures*

Program Area Category	Research**	Technology Transfer	CTI Academy	Advanced Institute	Total
Personnel	3,587,214	401,434	516,728	56,000	4,561,376
Operating	1,691,091	361,522	359,378	3,284	1,691,091
Equipment	86,576	2,460	5,206		94,242
Indirect Costs	896,929		167,908	755	1,065,592
Total	6,261,810	765,416	1,049,220	60,039	8,136,485

Distribution by Program Area



Distribution by Category



*Expenditure detail by subcategory of expense is available upon request (1-800-432-0719) or on the Center's Web site: www.ktc.uky.edu

**The research/study program for FY 04 consisted of over 100 projects conducted for the following agencies: the Kentucky Transportation Cabinet, Kentucky State Police, USDOT/FHWA, USDOT/FMCSA, NCHRP, BTS, TCRP, NORPASS, TARC (Louisville), KIPDA, Lexington-Fayette Urban County Government and various other public jurisdictions. Some work is done in cooperation with other universities including: Northwestern University, University of Louisville, University of Connecticut, University of Michigan, and Calspan-University of Buffalo Research Center and also in partnership with private firms such as CH2M Hill, and HMB Professional Engineers.

2004/2005 New Kentucky Highway Research Projects

- WIM Technologies Review (05-284)
- Review of Kentucky Drivers Manual (05-285)
- Analysis of Design/Operating Speed Inconsistencies (05-286)
- Evaluation of Work Zone Safety (05-287)
- Incident Management Strategic Plan (05-288)
- Route Disruption Analysis (05-289)
- Access Management Plan Implementation (05-290)
- Bridge Coating Evaluation (05-291)
- Disposal of Bridge Paint Debris (05-292)
- Analysis of Roadway Construction Costs (05-293)
- Recycling Practices (05-294)
- Conceptual Cost Estimating Guide (05-295)
- By-Products Resource Manual (05-296)
- Evaluation of Highway Culvert Extension Materials (05-297)
- Durability Issues of Asphalt Pavements (05-298)
- Kentucky Hot-Mix Pavements Evaluation (05-299)
- Distress Levels and Rehabilitation Cycles (05-300)
- Project Cost Management Tracking System (05-301)
- Transportation Finance Issues (05-302)
- Statewide Planning Scenario Synthesis (05-303)
- Rideability Issues for Pavements (05-304)

Research Reports Published During FY 2003-2004

KTC-04-1/SPR107(4)98-2F	"Evaluation of the ET2000 Guardrail End Treatment," Kenneth Agent, January 2004.
KTC-04-2/SP257-03-1F	"Effect of Pavement Resurfacing on Traffic Safety," Kenneth Agent, Jerry Pigman and Eric Green, February 2004.
KTC-04-3/SPR263-02-1F	"2003 Motor Carrier Survey," Ronald Langley and Ted Grossardt, Feb. 2004.
KTC-04-4/RSF7-99-1F	"Fuel Tax Compliance Project," James M. Clark, David Stachnik, Collene Griffin, Marlene Erickson and Jeff Keelen, February 2004.
KTC-04-5/SPR251-01-1F	"Access Management for Kentucky," Nick Stamatiadis, Barry House, Jeremy Brickey, Don Hartman, Mei Chen, Jerry Pigman, Kavita Boodu, Soni Patangay and Emily Elwood, January 2004.
KTC-04-6/RSF7-99-2F	"The Fuel Tax Compliance Unit: An Evaluation and Analysis of Results," Suzanne Perkins Sapp, January 2004.
KTC-04-7/SPR278-03-1F	"2004 Highway Cost Allocation Update: Technical Report," Monica Barrett and Jerry Pigman, February 2004.
KTC-04-8/SPR276-04-1F	"Evaluation of the Accuracy of GPS as a Method of Locating Traffic Collisions," Eric Green and Kenneth Agent, May 2004.
KTC-04-9/FR117-1thru 4	"Cross Drain Inspection for I-65, Mile-Points 0-24.8 and 40.5-91.3," Brad Rister, Jonathan Fisher and Jamie Creech, May 2004.
KTC-04-10/FR128-03-1F	"Evaluation of Traffic Information and Prediction System (TIPS) as Work Zone Traffic Control," Jerry Pigman and Kenneth Agent, March 2004.
KTC-04-11/SPR204-99-1F	"Context Sensitive Design—Thinking Beyond The Pavement Documentation of Workshop Development and Training," Jerry Pigman, Donald Hartman, Theodore Hopwood, Kenneth Agent and Len O'Connell, May 2004.
KTC-04-12/SPR258-03-3F	"U-Turns at Signalized Intersections," Nikiforos Stamatiadis, Teja Banu Kala and Kenneth Agent, May 2004.
KTC-04-13/SPR225-01-1F	"Case Study (4f) Litigation/Rulings," Len O'Connell and Theodore Hopwood, June 2004.
KTC-04-14/SPR241-02-1F	"Maintenance and Operations Plan for ITS in Kentucky," Jennifer Walton and Joe Crabtree, June 2004.
KTC-04-15/PL4-03-1F	"Assessment of Data Collection for ESAL Determinations for the Kentucky Transportation Cabinet, Division of Planning," David Q. Hunsucker and Clark Graves, May 2004.

FY 2003-2004 Research Reports (Continued)

KTC-04-16/TA5-03-1F	"Debt Capacity and Debt Limits: A State Road Fund Perspective," Merl Hackbart, Suzanne Perkins Sapp and Yongbeam Hur, May 2004.
KTC-04-17/SPR263-03-3F	"Kentucky Highway User Survey 2004," Ted Grossardt and Ronald Langley, June 2004.
KTC-04-18/KSP-04-1I	"Evaluation of Kentucky's 'Buckle Up Kentucky: It's the Law and It's Enforced,'" 2004 Campaign, Kenneth Agent and Eric Green, July 2004.
KTC-04-19/KSP1-04-1F	"2004 Safety Belt Usage Survey in Kentucky," Kenneth Agent and Eric Green, August 2004
KTC-04-20/SPR179-98-1F	"Evaluation of the Service Performance of Bridge Components," Theodore Hopwood, Robert Brown and Sudhir Pale, August 2004.
KTC-04-21/FRPDeck1-97-1F	"Inspection of Evaluation of a Bridge Deck Partially Reinforced with GFRP Rebars," Issam Harik, P. Alogusundaramoorthy, V. Gupta, R. Suman, C. D. Hill and I. Renot, August 2004.
KTC-04-22/SPR209-00-1F	"Optimization and Standardization of Pavement Management Processes," David Allen and Yuhong Wang, August 2004.
KTC-04-23/KIPDA-02-1F	"Developing an Intelligent Transportation Systems (ITS) Architecture for the KIPDA Region," Joe Crabtree and Jennifer Walton, August 2004.
KTC-04-24/SPR268-02-1F	"Safety and Health Concerns for KyTC and Contractor Personnel," Theodore Hopwood and Sudhir Pale, September 2004.
KTC-04-25/KSP2-02-1F	"Analysis of Traffic Crash Data In Kentucky (1999-2003)," Kenneth Agent, Jerry Pigman, Monica Barrett and Eric Green, September 2004.



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Jeffrey Norwood Garrison
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Buddy Smith
McCracken County Project Engineer and Advisor
(At-Large)

N. E. Reed
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(Representing Kentucky County Judge/Executive Association)



Locations of Kentucky Transportation Center Staff



*Main Office and Labs
Raymond Building*



*Technology Transfer Program
Center for Manufacturing Building*



*Structures and Coatings
Garages and Labs
Whalen Building*



*Planning, Financial, Environmental
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Kentucky Transportation Center